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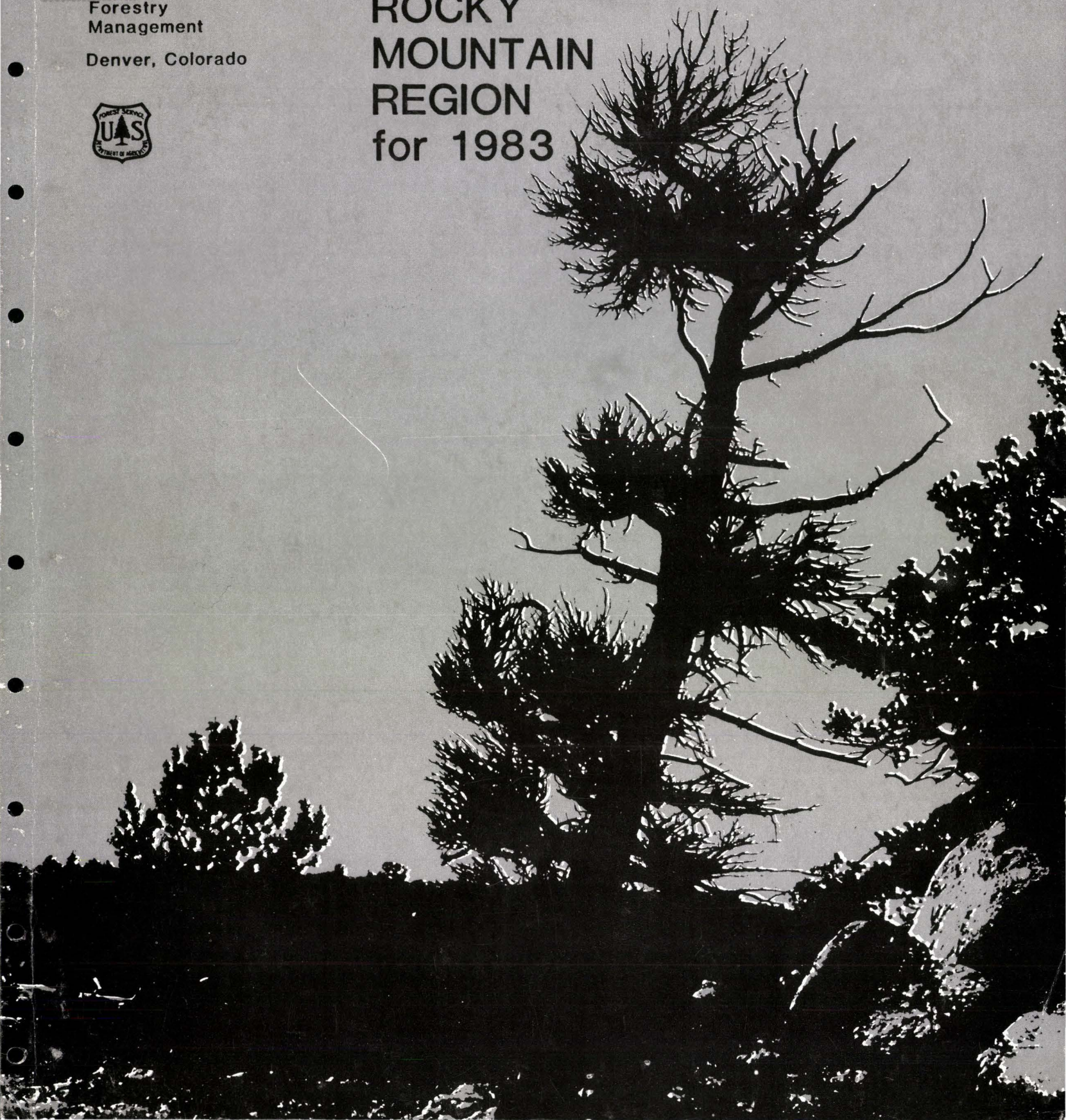
FOREST PEST CONDITIONS IN THE ROCKY MOUNTAIN REGION for 1983



FOREST INSECT AND DISEASE CONDITIONS IN THE ROCKY MOUNTAIN REGION 1983

by

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ACKNOWLEDGEMENT

The Forest Pest Management staff extends appreciation to all cooperators for aid in the preparation of this annual report. The following organizations contributed information to this report: Colorado State Forest Service; Colorado State University; Kansas State University and Cooperative Extension Service; Nebraska Department of Forestry, Fisheries and Wildlife; South Dakota Department of Game, Fish and Parks, Division of Forestry; the Rocky Mountain Forest and Range Experiment Station, and the National Forests in the Rocky Mountain Region.

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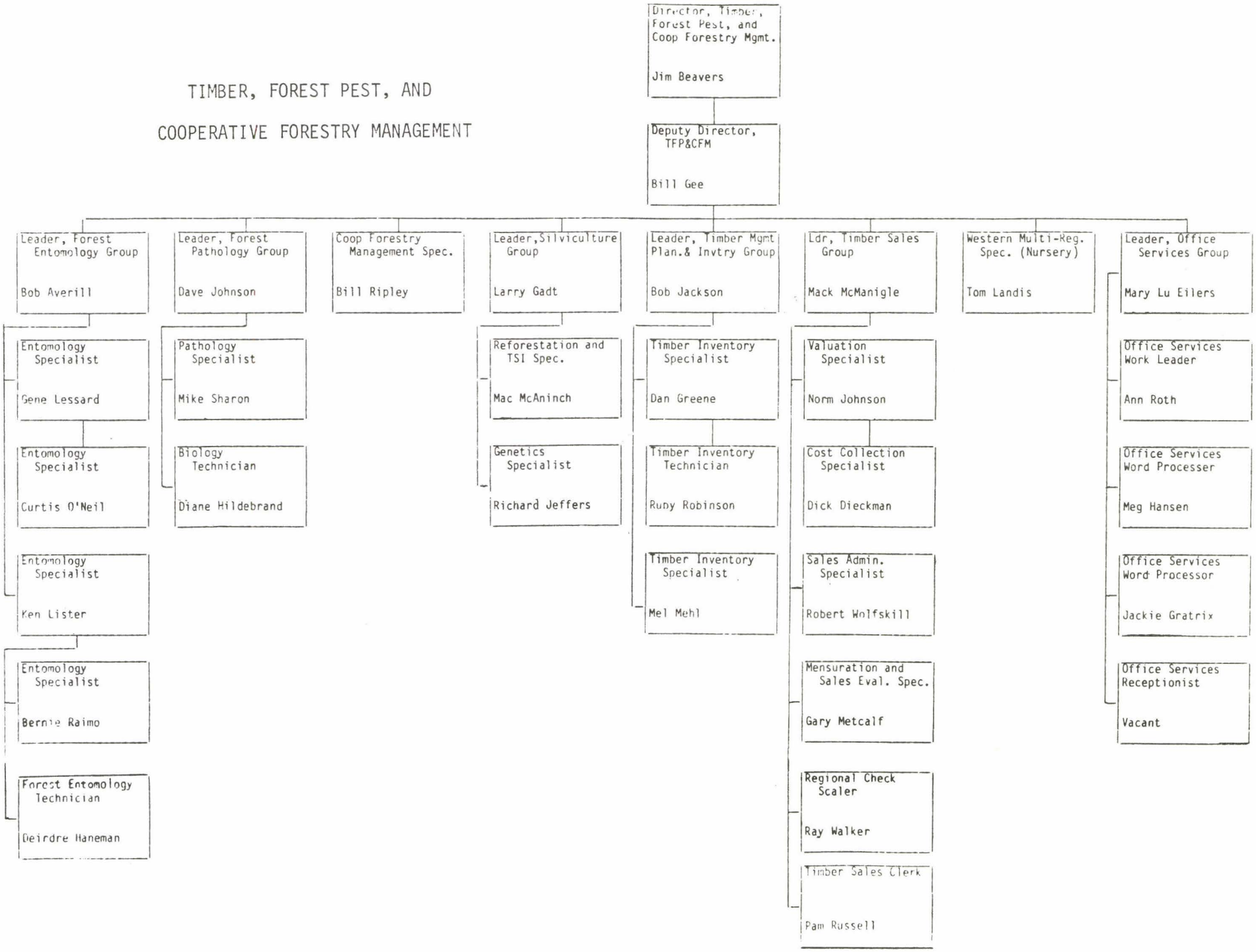
TIMBER, FOREST PEST, AND COOPERATIVE FORESTRY MANAGEMENT



DISEASE AND INSECT CONDITIONS IN BRIEF

Lodgepole pine dwarf mistletoe and comandra blister rust continue as the most damaging disease agents in the Rocky Mountain Region. This past year Forest Pest Management funds were greatly supplemented by funds from the Jobs Bill Program in order to conduct presuppression surveys on 13,680 acres of lodgepole pine dwarf mistletoe. Silvicultural control was conducted on 7,820 acres. Action plans for survey and suppression of lodgepole pine dwarf mistletoe must be continued in order to increase the productivity of lodgepole pine stands throughout the Region.

A survey on the Wind River Ranger District, Shoshone National Forest, Wyoming, revealed that more than half of the sawtimber-size lodgepole pine were infected with comandra blister rust in those stands less than 4 km from the alternate host. Present volume of a sawtimber-size lodgepole top-killed by comandra blister rust was 68 percent of expected volume.

Dutch elm disease has continued to spread in South Dakota, with four new counties confirmed: Campbell, Corson, Ziebach, and Dewey. Only five counties remain unconfirmed out of 66.

Foliage diseases increased in incidence and severity due to the cool wet spring. Apple scab caused by Venturia inaequalis was reported for the first time in Colorado.

Mountain pine beetle continues as the most significant bark beetle in the Rocky Mountain Region. Beetle infestations in ponderosa pine are, for the most part, decreasing except in the Black Hills and Uncompahgre plateaus. Infestations in lodgepole pine, however, continue to expand rapidly. The Summit-Upper Eagle suppression effort near Dillon, Colorado, in 1983 resulted in chemical treatment of 48,000 infested trees, chipping of 4,600, and salvage logging of 82,600. Areas of infested lodgepole pine have doubled to 215,000 acres in north central Colorado. Infested area in Wyoming covers 63,000 acres.

The spruce beetle outbreak continues on the Rio Grande National Forest. The area of infestation is 26,350 acres.

Douglas-fir beetle losses are building in Colorado, especially where stands have been repeatedly defoliated by western spruce budworm.

Western spruce budworm remains widespread in the Region, with an increasing trend over the past five years.

The Western tent caterpillar infestation continues to expand, with the acres of defoliation almost doubling in southern Colorado.

INTRODUCTION

Forest Pest Management (FPM) is responsible for detection, evaluation, prevention, and suppression of insects and diseases on forested Federal lands. In addition, FPM administers assistance programs, both financial and technical, which are available to state and private landowners of forested lands through the Cooperative Forestry Assistance Act of 1978 (Public Law 95-313).

In 1983, ground and aerial surveys were performed to detect insect and disease infestations throughout the Rocky Mountain Region, many in cooperation with State Pest Specialists in Colorado, Kansas, Nebraska, South Dakota, and Wyoming.

STATUS OF DISEASES

LODGEPOLE PINE DWARF MISTLETOE: *Arceuthobium americanum* Nutt.

Action plans for survey and suppression of lodgepole pine dwarf mistletoe have been continued throughout the Region. Presuppression surveys were conducted on 13,680 acres on the Pike and San Isabel, Gunnison, and Routt National Forests and state-owned lands in Wyoming. Silvicultural control was conducted on 7,820 acres of infested lodgepole pine stands on the Arapaho and Roosevelt, Gunnison, Medicine Bow, Pike and San Isabel, Routt, Shoshone and White River National Forests, and state-owned lands in Wyoming. The majority of the work was accomplished with the Jobs Bill Program.

Colorado State University forest fire researchers, in cooperation with the Rocky Mountain Forest and Range Experiment Station (RMS), are continuing to investigate the ecological interactions of dwarf mistletoe and fire in lodgepole pine forests. Studies are in progress to evaluate the heat tolerance of dwarf mistletoe plants, the direct effects of fire on both the parasite and host trees, and to assess the interrelationships between fire history and dwarf mistletoe spread and intensification.

A lightweight, incubator-like apparatus was constructed to permit high temperature exposure of living dwarf mistletoe shoots still attached to the host branch. Results indicate that shoot survival was dependent on both the temperature and length of exposure. Mortality slightly increased as exposure times increased at each of four temperatures: 45, 50, 55, or 60°C. After 2 minutes at 60°C, however, mortality substantially increased. This indicates that dwarf mistletoe aerial plant parts are subject to mortality from hot gases (scorch mortality) just as host foliage is. Understory, surface fires could conceivably scorch "prune" the lower, mistletoe-infected branches without killing the entire tree and check or slow the spread of disease.

Individual tree physical characteristics, dwarf mistletoe rating, and postburn measurements of average percent crown scorch, consumption, and height of stem char are being used to assess the impacts of fire on dwarf mistletoe and host lodgepole pine trees. Preliminary results indicate that dwarf mistletoe infection levels are primarily reduced as a result of host tree mortality. Average percent crown scorch is most responsible for post fire mortality in lodgepole pine trees. Provided sufficient crown foliage survives to sustain the entire tree, horizontal stem damage is relatively unimportant. In fact, one individual has been found which survived 93 percent stem girdling by fire.

An additional study is underway to investigate the correlation between fire and dwarf mistletoe history. Fire scarred cross-sections have been collected from 15 sites on the Gunnison National Forest and will be used in conjunction with recorded fire occurrence to estimate fire history in the Taylor Park

Area. Dwarf mistletoe frequency and intensity of these different sites will be compared to evaluate how fire presence or absence has contributed to current infection conditions.

Establishment of lodgepole pine dwarf mistletoe beyond the normal range of explosively-discharged seeds indicates the involvement of vectors. In 1982 and 1983, studies were conducted by the the Rocky Mountain and North Central Forest Experiment Stations at the Fraser Experimental Forest, Colorado, to investigate long-distance seed dispersal. The 1982 studies concentrated on trapping birds (mist nets) and animals (cell traps) at three sites (9,000; 9,400; and 10,000 feet). At each site, dwarf mistletoe seed dispersal was monitored by making daily counts of seed traps on the ground near infected trees. This preliminary study has shown that at least 11 animal species carry lodgepole pine dwarf mistletoe seeds--eight birds and three mammals. The most important potential vectors are Steller's jay, gray jay, and least chipmunk. For the entire study period, ten percent of 420 animals caught carried seed (birds seven percent, and mammals 18 percent). During the two week peak seed dispersal period at one site, 21 percent of the animals carried seed (birds 22 percent, and mammals 20 percent). Analysis of the 1983 studies are not yet completed but they involved (1) detailed surveys to determine the number and size of isolated mistletoe infected centers, and (2) radio telemetry to monitor movement of seed-bearing animals between infested and uninfested stands.

Mistletoe blister rust (Peridermium bethelii Hedge. & Long), which is associated with lodgepole pine dwarf mistletoe, was found to be common in two new areas of Colorado: Taylor Park in the Gunnison National Forest, and on the Fraser Experimental Forest, Arapaho National Forest.

PONDEROSA PINE DWARF MISTLETOE: Arceuthobium vaginatum subsp. cryptopodum (Engelm.) Hawks and Wiens.

Evaluation of a combination road/plot dwarf mistletoe survey of ponderosa pine was conducted on the Roosevelt, Pike, and San Juan National Forests in Colorado. Occurrence of dwarf mistletoe was recorded along roads to the nearest 0.01 mile for distances up to 1.0 mile. A row of plots was then established at five-chain intervals two chains from and parallel to the same surveyed portion of the road. Regression analyses of the data were performed to determine if the amount of dwarf mistletoe infection observed from the road was representative of the amount of infection occurring a short distance into the forest. A coefficient of determination (R^2) value of 0.88 was achieved for all three National Forest combined, indicating a high correlation between roadside and plot information. Survey data indicated that 20 percent of the ponderosa pine type is infected.

Researchers at Colorado State University have completed a preliminary analysis of available data on stand composition and ponderosa pine dwarf mistletoe incidence and severity in the Colorado Front Range. This information will be used to prepare sampling schemes and techniques for the 1984 summer season. During 1984, temporary plots will be established in irregular ponderosa pine stands along the Front Range to supplement existing data. Several sampling criteria will be used to select sample sites, including dwarf mistletoe severity, basal area-density classes, site incidence and size-class distribution classes.

COMANDRA BLISTER RUST: Cronartium comandrae Peck

In a cooperative (FPM, RMS, Shoshone National Forest, and CSU) study, comandra blister rust research was carried out at the Wind River District of the Shoshone National Forest, Wyoming, this year. The purpose of the research was to help determine the ecology of this rust. Comandra plant distribution and location were focused on this past summer. Future research will involve taking a closer look at infected lodgepole stands, and making correlations between site factors and infection. The ultimate goal of this study is to develop a usable risk rating sytem for managers.

Comandra blister rust continued to cause mortality and growth loss to lodgepole pine within infested areas. A disease incidence survey on the Wind River District revealed that more than half of the sawtimber-size lodgepole pine was infected in those stands closer than 2-4 km from the alternate host. Growth loss from comandra blister rust was estimated for a typical top-killed tree on the District. The present volume of an 87 year old, 22 cm diameter tree with canker which killed the top third of the stem 17 years ago was 68 percent of expected volume. Younger trees on the District have been killed by comandra blister rust. In one stand, established about 1956 and heavily infested four years later, 46 percent of trees cankered in 1973 were dead by 1983. An additional 32 percent were alive but still diseased. Only 20 percent of those trees observed in 1973 to be diseased had shed infected branches before a stem infection developed. Few new infections have been seen in that stand over the past 10 years.

DUTCH ELM DISEASE: Ceratocystis ulmi (Buism.) C. Mor.

In 1983, Dutch Elm Disease (DED) was confirmed present in four new counties in South Dakota: Campbell, Corson, Ziebach, and Dewey. This leaves only five counties unconfirmed for the state (Figure 1). The South Dakota Division of Forestry conducted a survey of 51 percent of the communities in the eastern two-thirds of the state and found that 6.6 percent, or 4,786, trees have been lost to the disease in communities in 1983. There are an estimated 68,000 remaining susceptible community elms out of an original 375,000 in the survey area in 1967.

The Colorado State Forest Service reported 773 cases of DED in 57 of the 122 areas in the state with significant elm populations. Excellent sanitation programs are in effect in 71 of these 122 areas.

THYRONECTRIA CANKER: Thyronectria austro-americana (Speg.) Seeler.

Thyronectria canker continues to cause losses to urban honeylocusts, and is the most common disease on privately owned honeylocust throughout Colorado. Field observations indicate environmental stresses predispose the trees to this disease. Greenhouse research and field observations by researchers at Colorado State University are continuing in an attempt to determine which stresses are the most important. Screening of honeylocust cultivars for resistance to the canker was initiated in 1983 and should be completed in 1984. In vitro work with the fungus indicated it is a versatile organism that can grow, sporulate, and germinate under wide ranges of nutritional and environmental conditions.

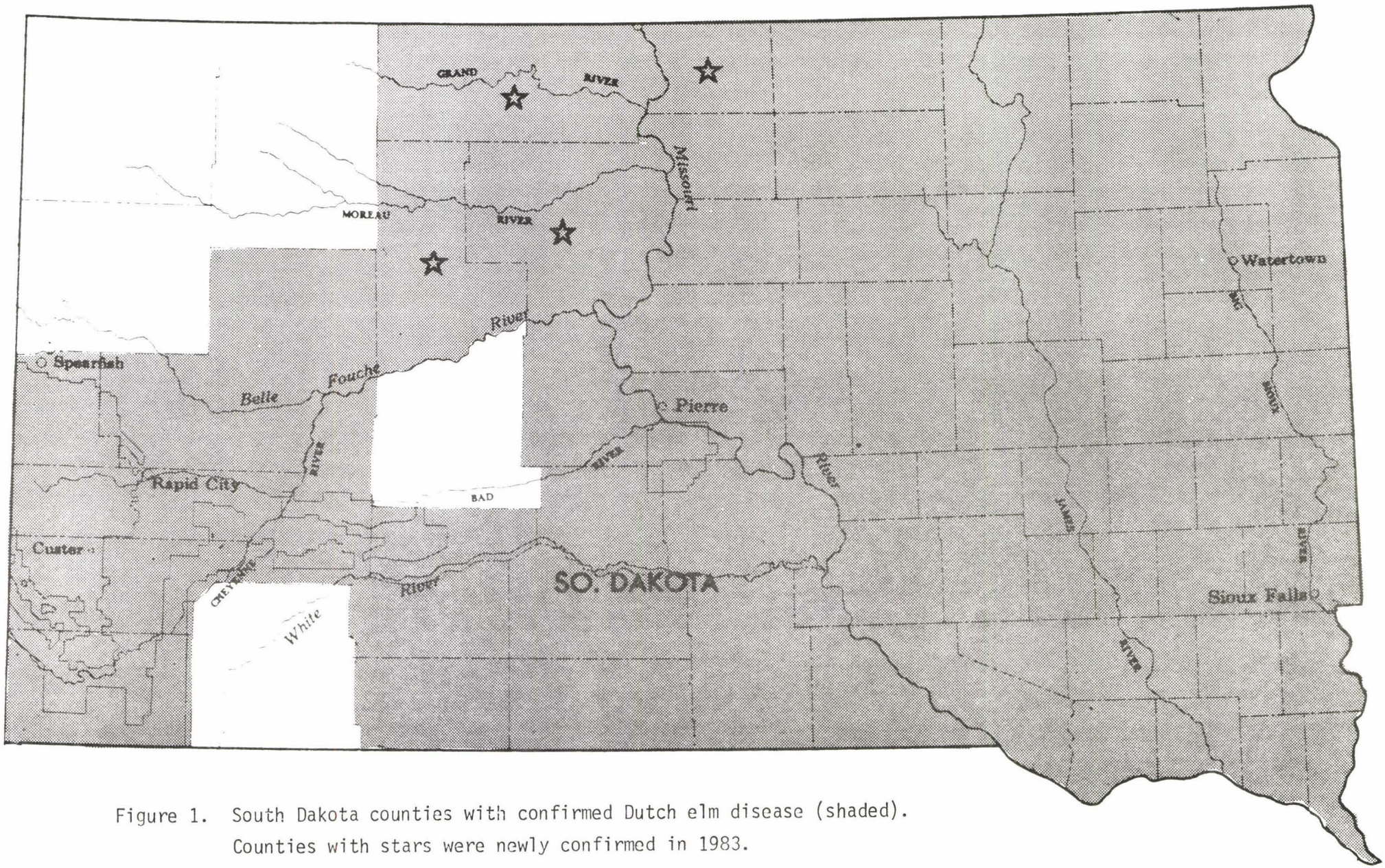


Figure 1. South Dakota counties with confirmed Dutch elm disease (shaded). Counties with stars were newly confirmed in 1983.

NURSERY DISEASES:

An evaluation of soil solar heating for control of soil-borne pathogens and weeds was completed at the Colorado State Forest Service Nursery in 1983. Significant reductions in populations of the damping-off pathogens, Pythium spp. and Fusarium spp., and of weeds were achieved through the technique. A technical report of the project will be available early in 1984.

A similar evaluation of soil solar heating was begun at the Bessey Nursery in Nebraska last summer. Effects of solar heating on populations of the nematode Pratylenchus penetrans (Cobb) Sher and Allen will be evaluated in addition to those of Pythium spp, Fusarium spp, and weeds.

The Bessey Nursery reports persistent losses due to shothole disease (probably caused by Coccomyces spp) in chokecherry. During the 1984 growing season Dodine (Cyprex, American Cyanamid) will be applied to the chokecherries with a small area left untreated as checks.

JACK PINE DECLINE "Peters Out":

In 1978 an investigation was initiated to determine etiology, extent, and distribution of jack pine decline in plantations within the Nebraska National Forest. Data from ground transect and variable plot surveys indicated that approximately 16 percent of the sampled trees were dead or declining. Secondary insects, particularly Ips calligraphus and Dendroctonus valens, were associated with the decline. The major fungal associate was Ceratocystis minor.

Eight semi-permanent plots (one within each stand surveyed extensively) were established in 1978 to monitor stand deterioration. Plots were examined in 1980, 1982, and 1983. The number of new kills since 1978 has decreased significantly.

Dead Trees	New Kills		
1978	1980	1982	1983
55	20	8	2

A parallel trend was observed in the pattern of trees with symptoms.

In September 1982, Fomes annosus was reported for the second time on the Nebraska National Forest. Stewart first reported it in 1965. However, F. annosus was not found on any plot tree during the 1983 examination. Because of the significant decrease in " new" kills and symptomatic trees, the investigation has been concluded. Neither a primary pathogen nor insect has been associated with the decline. The etiology of jack pine decline is unknown.

ASPEN MORTALITY IN PARTIAL CUT STANDS:

Since 1974-75, the Rocky Mountain Forest and Range Experiment Station, in cooperation with the Rocky Mountain Region and Southwest Region FPM staffs,

have analyzed causes of mortality occurring in partially harvested aspen stands in southern Colorado and northern New Mexico. Results indicate significant mortality (26 percent) of the residual stand to canker fungi, root diseases, and windthrow within 8-9 years following harvest. Resource managers should not expect to re-enter partial cut stands after 15-20 years anticipating the harvest of residual trees with these rates of mortality.

AIR POLLUTION:

The permanent air pollution evalution plots were examined once in 1983. Previously, we had examined them in the spring and fall. Ponderosa pine examined along the front range from Boulder to Colorado Springs did not show typical symptoms of ozone injury.

HAZARD TREES IN FORESTED RECREATION SITES:

A Region-wide survey was completed to determine the hazard tree status in developed recreation sites. Approximately 7,300 trees were examined in a total of 54 fee campgrounds. Data is being analyzed and a report will be out this year.

OTHER DISEASES

Disease	Host	Location	Remarks
STEM AND BRANCH DISEASES			
Dwarf mistletoes *Arceuthobium americanum* Nutt. ex Engelm.	Lodgepole pine	Colorado, Wyoming	Continues as the most important disease problem in the Region. An estimated 51% of the type is infested. The annual merchantable loss is approximately 10 million cubic feet on National Forests alone. Presuppression and silvicultural control activities were conducted on 21,500 acres this year using funds from the Jobs Bill Program, as well as FPM funds. Preliminary studies by the Rocky Mountain Forest and Range Experiment Station show that several birds and mammals carry dwarf mistletoe seeds. Data from radio-monitoring of seed-bearing animals moving between infested and uninfested stands, and from surveys of the number and size of isolated mistletoe infection centers, are being analyzed.
Arceuthobium vaginatum subsp. *cryptopodum* (Engelm.) Hawks. and Wiens	Ponderosa pine	Colorado	From an extensive roadside survey of ponderosa pine stands on 3 National Forests, estimated 20% of the type is infested. An evaluation of the roadside survey technique showed a very high correlation between dwarf mistletoe intensity along the roadside and conditions 2 chains from the road.
Mistletoe blister rust *Peridermium bethelii* Hedge. & Long.	Lodgepole pine	Colorado	This rust, which is associated with *A. americanum*, was found to be common in two new areas: Taylor Park in the Gunnison National Forest; and in the Fraser Experimental Forest, Arapaho National Forest.

Disease	Host	Location	Remarks
Comandra blister rust *Cronartium comandrae* Pk.	Lodgepole pine	Western Wyoming	Continues as the most important disease problem on the Wind River Ranger District, Shoshone National Forest. A survey of the commercial lodgepole pine type indicated the rust is a primary cause of mortality in at least 50% of the standing dead saplings and poles.
Thyronectria canker *Thyronectria austro-americana* (Speg.) Seeler	Honeylocust	Colorado, Kansas	Most common disease on privately owned honeylocust throughout Colorado, causing mortality in the Denver area. Severe in western Kansas windbreaks.
Slime flux *Erwinia* sp. *Cornynebacterium* sp.	Cottonwood, elm, maple, willow	Colorado	Common in the Denver area, some reports elsewhere. Severe infections cause leaves to dry up and drop early.
Crown gall *Agrobacterium tumefaciens* (Smith & Town) Conn.	Cottonwood	Colorado	Some reports this year.
Siberian elm canker *Botryodiplodia hypodermia* (Sacc.) Petr. & Syd.	Siberian elm	South Dakota	Of nine shelterbelts (generally 20 years old) surveyed, all were infected; 85% of the trees were infected, usually with one or a few small cankers.
Cytospora canker *Cytospora* spp.	Various hosts	Colorado	Cankers girdled branches and boles, resulting in considerable dieback and some mortality.
Gummosis	Sumac	Colorado	Some reports this year.
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) Mill.	Aspen	Southwestern Colorado	Common on Mancos Ranger District, San Juan National Forest.

Disease	Host	Location	Remarks
VASCULAR WILTS			
Dutch elm disease *Ceratocystis ulmi* (Buism.) C. Mor.	American elm	South Dakota	Confirmed in 4 new counties; Campbell, Corson, Ziebach, and Dewey, only 5 remaining out of a total of 66 in the state unconfirmed. A survey of 51% of communities in the eastern 2/3 of of the state indicated losses of 6.6% or 4,786 urban trees in 1983. In the survey area, 68,000 susceptible elms remain from an original 375,000 in 1967.
Dutch elm disease	Elm species	Colorado	773 cases reported in 57 of 122 areas with significant elm populations. Excellent sanitation programs are being conducted in 71 of these 122 areas.
Dutch elm disease	American elm	Nebraska	Continues to be a problem throughout the state.
Verticillium wilt *Verticillium* sp.	Sumac, catalpa, silver maples, Golden Raintree and Russian olives	Front Range Colorado	Often isolated this year. Continues at low level in Denver area.
ROOT DISEASES			
Armillaria root disease *Armillariella mellea* (Vahl. ex Fr.) Karst.	All conifers	Colorado, Wyoming, South Dakota	This disease remains the most prevalent root disease in the Region. A mortality survey on 363,200 acres of the San Juan National Forest indicated 24% of the spruce-fir type surveyed was infected. Mortality of subalpine fir at two Colorado ski areas stimulated interest in the formulation of long term vegetation management plans. *Armillariella mellea* and several bark beetles are involved, including *Scolytus* spp. and *Dryocoetes confusus*.

Disease	Host	Location	Remarks
			A survey conducted around Deadwood, South Dakota, in the Black Hills National Forest, implicates A. mellea infected ponderosa pine as foci for mountain pine beetle attacks during endemic beetle cycles.
			Widespread subalpine fir mortality attributed to western balsam bark beetle and root rot continues throughout the White River National Forest.
Annosus root rot Heterobasidion annosum (Fr.) Bref.	Jack pine	Nebraska	Additional infection centers found on the Bessey Ranger District, Nebraska National Forest. The present area of infection is about 1/4 acre where some earlier thinning had taken place. No trees are being cut within 30 ft. of the infested area, and stump surfaces are treated with Borax.
Black-stain root disease Ceratocystis wageneri Goheen & Cobb	Pinyon	Western Colorado	The primary root disease in pinyon type west of the Continental Divide. Trenching and silvicultural treatments are being tested in Mesa Verde National Park to limit spread of the disease. Collection and isolation of fungi from insect vectors and studies on the longevity of the pathogen within killed trees continues.
FOLIAGE DISEASES			
Anthracnose Gloeosporium spp.	Sycamore Walnut maple	Colorado, Kansas	Some reports this year. Considerable defoliation frequent in Denver metropolitan area.
Gnomonia platani Edg.	Sycamore	Nebraska	Common throughout state.
Gnomonia leptostyla (Fr.) Ces. & deNot	Walnut	Eastcentral South Dakota	Abnormally cool, wet spring weather increased incidence and severity. Over 300 trees in two small plantations in Newton Hills State Park were heavily infected.

Disease	Host	Location	Remarks
Gloeosporium aridum Ell. & Holw.	Green ash	Eastern Nebraska	Common.
Juniper blight *Phomopsis juniperovora* Hahn & *Cercospora sequoiae* E.& E.	Eastern redcedar & Rocky Mtn. juniper	Eastcentral South Dakota	Numerous reports of light infections aggravated by cool, wet spring.
Fir needle rust *Pucciniastrum goeppertianum* (Kuehn) Kleb.	White fir, subalpine fir	Colorado	Branches with yellow aecia on needles collected in the Fall on Arapaho and Roosevelt, and Grand Mesa National Forests.
Marssonina blight and leaf spot *Marssonina populi* (Lib.) Magn.	Aspen, poplars	Colorado	Very common throughout state due to very wet spring. Some premature defoliation.
Powdery mildew *Podosphaera leucotricha* (E. & E.) Salm. and fire blight *Erwina amylovora* (Burr.) Winsl.	Apple	Colorado	Very common throughout state due to very wet spring.
Shepherd's crook *Venturia macularis* (Fr.) Muller & von Arx	Poplars	Colorado	Very common this year. Spread during wet weather.
Shot hole leaf spot *Coccomyces* sp.	Plum	Colorado	Some reports this year.
Conifer aspen rust *Melampsora medusae* Thuem.	Aspen	Colorado	Some reports this year.

Disease	Host	Location	Remarks
Diplodia tip blight *Diplodia pinea* (Desm.) Kickx.	Ponderosa pine	South Dakota	Small infections reported frequently throughout State, including Bennett County. Large numbers of infected trees reported from shelterbelts in Sioux Falls District, including over 200 trees on one acre. In Black Hills, infection is still declining from 1979 reports.
	Austrian and ponderosa pine	Nebraska, Kansas	Branch dieback and tree mortality common in windbreaks and urban plantings.
Needlecasts *Lophodermium* sp.	Lodgepole pine	Wyoming	Extensive areas with low-grade infection following 2 or 3 seasons of frost damage on the Bighorn National Forest.
Ink Spot *Ciborinia whetzelii* (Seaver) Seaver	Aspen	Colorado	Widely observed this year. The Crystal River drainage and the Aspen area, White River National Forest, were heavily infected.
Apple scab *Venturia inaequalis* (Cke.) Wint. ap. Thum	Crabapple	Colorado	Reported for the first time in this state near Steamboat Springs.
NURSERY DISEASES			
Fusarium root rot *Fusarium oxysporum* Schlect.	Lodgepole pine	Nebraska	Isolated from dying 1-0 pine at the Bessey Nursery. The infection was in an area where the nursery bed cannot be fumigated due to permanent irrigation pipes, so infested soil is always present, serving as a source of inoculum to the adjacent seedbeds.
Shothole *Coccomyces* sp.	Chokecherry	Nebraska	The disease was not controlled by regular application of Benlate at the Bessey Nursery. Control trials using Cyprex fungicide are planned for 1984. The pathogen is probably *Coccomyces* sp., but has not been confirmed.

Disease	Host	Location	Remarks
Damping-off *Pythium* spp. and *Fusarium* spp.	Conifers	Colorado	Evaluation of soil solar heating for control of pathogens and weeds was completed at CSFS Nursery, Fort Collins. Significant control was achieved with the techniques.
Damping-off and nematodes *Pratylenchus* sp.	Conifers	Nebraska	Evaluation of soil solar heating for control of pathogens and weeds was begun at Bessey Nursery. Evaluation will be completed next year.
Sirococcus shoot blight *Sirococcus* sp.	Ponderosa pine	Colorado	Ponderosa pine seedlings growing at the Southern Ute Greenhouse (USDI, BIA) exhibited purplish shoot dieback attributed to *Sirococcus* sp., but not confirmed.
ABIOTIC			
Leaf scorch	Hardwood species	South Dakota	Due to very hot dry weather from mid-June to late September, after a wet spring. Largest single cause of requests for assistance from landowners this year.
Herbicide drift	All species	Eastern South Dakota	Many more instances than usual this year. Over a dozen cases known, approximately two dozen more suspected. 40 acres severely damaged near Yankton from drifting spray.
Air pollution	Ponderosa pine	Front Range, Colorado	Examination of permanent plots indicated no ozone injury.
OTHER			
Yellow bellied sapsucker *Sphyrapicus varius*	Pine, juniper, spruce	South Dakota	Numerous reports throughout state. Light to heavy damage on individual trees and throughout shelterbelts. In one shelterbelt near Chamberlain, 25 spruce sustained heavy damage.

Disease	Host	Location	Remarks
Hackberry decline	Hackberry	Nebraska, Kansas	Continues to be a problem in urban areas and windbreaks, possibly due to herbicide damage and cankerworm defoliation.
Spruce decline	Spruce species	Eastern South Dakota	For the past few years, an unknown decline of ornamental spruce has been noted that results in early casting of needles beginning on a few branches then eventually over the entire tree. No mortality noted.
Dieback and wilt of Russian olive	Russian olive	Colorado	Causal agent unknown. No estimate of loss available. Suspected to be a complex with soil moisture and root and vascular wilt pathogens.
Aspen mortality	Aspen	Southern Colorado, northern New Mexico	Partial cutting of aspen results in 26% mortality of residuals within 9 years due to canker and root disease fungi and windthrow. This information comes from cooperative studies conducted since 1974 by the Rocky Mtn. For. & Range Exp. Sta., the Rocky Mtn. Region, and the Southwest Region FPM staffs.
Conifer decline	Especially pines	Southwest Colorado	Extensive areas suffering, suspected environmental malady involving moisture stress and/or air pollutants. Various insects present in these areas; further investigation planned.
Ponderosa pine mortality	Ponderosa pine	South Dakota	Mortality on an extensive area of the Harney Ranger District, Black Hills National Forest; etiology not confirmed.
Jack pine decline	Jack pine	Nebraska	Results from a 5-year study indicate that the jack pine is no longer declining on the Nebraska National Forest.
Hazard trees	All species	Region-wide	A survey of 54 fee campgrounds, with 7300 trees examined, was undertaken this year. Data is being analyzed.

Disease	Host	Location	Remarks
Pinewood nematode *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle	Pine	Kansas	Reported from southeastern counties. Intense concern expressed by individuals in that area.

STATUS OF INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE: Dendroctonus ponderosae Hopkins

Mountain pine beetle continues its role of being the most significant bark beetle in the Rocky Mountain Region. Infestation activities occur on 336,000 acres, killing about 1.16 million trees as detected from the air.

Mountain pine beetle has decreased to a low level of infestations in ponderosa pine. This respite is welcomed following the tremendous outbreaks which occurred during the 1970's in the Black Hills and Colorado Front Range. About 30,000 acres are infested in the Black Hills. The most serious tree mortality continues near Sundance Wyoming in the Black Hills. Sanitation salvage logging appears to help decrease the tree mortality annually, and further decreases are expected.

In Colorado, the outbreaks in ponderosa pine have all but disappeared along the Front Range. Moderate loss levels persist in southwestern Colorado on the San Juan and Uncompahgre National Forests and Bureau of Land Management lands near Blue Mesa Reservoir. Mountain pine beetle associated with round-headed, D. adjunctus Blandford, and western pine beetle, D. brevicomis Le Conte, form the beetle complex responsible for this mortality. Sanitation salvage is being utilized to slow the infestations. Infestation decrease was noted on the San Juan along the Dolores River. The salvage efforts on the Uncompahgre plateaus in 1982 and 1983 appeared to be effective and tree mortality decreases appeared to occur from the air. However, ground examinations following the 1983 attack period indicate a tremendous outbreak is developing, so tree losses are expected to increase on the Uncompahgre plateaus in 1984.

Elsewhere, in north central Colorado, mountain pine beetle continues to expand its attack in lodgepole pine. Aerial surveys conducted indicate the areas of infestation have doubled, involving 215,000 acres. The associated estimate of 1983 faders is almost 790,000 trees.

A large suppression effort in its second year centers around Dillon Reservoir and Minturn which is entitled, Summit-Upper Eagle (SUE). This is a joint project between the Colorado State Forest Service and White River National Forest. The 1983 suppression effort resulted in chemical treatment of 48,000 infested trees, chipping of 4,600, and salvage logging of 82,600.

Mountain pine beetle infestations in lodgepole pine found in Wyoming were mapped and estimated from the air. The infested acreage is 63,000 acres containing 345,000 faded trees. The Shoshone National Forest infestation continues to be intense and some portions of the infestation date back to 1969. Elsewhere in Wyoming, infestations occur on Casper, Muddy, Shirley, and Ferris Mountains in south central Wyoming. The newest infestation area, which is building rapidly, is mostly on the Medicine Bow National Forest in Roaring Forks and the North Forks drainage of the Little Snake River.

SPRUCE BEETLE: Dendroctonus rufipennis (Kirby)

The spruce beetle outbreak continues on the Rio Grande National Forest. The gross area of infestation is 26,350 acres. The Forest has recognized this infestation as a serious problem and has reprogrammed timber sales to concentrate accelerated cuts into the infested areas. The cutting strategies include salvage of infested, use of trap trees with timely removal, and marking and removal of high risk trees. This is the third year (1984) of cutting efforts in this infestation. Hopefully these cutting efforts will succeed in collapsing the outbreak soon.

DOUGLAS-FIR BEETLE: Dendroctonus pseudotsugae Hopkins

Douglas-fir beetle losses are building in Colorado. The most noteable is at Douglas Pass between Grand Junction and Rangley in western Colorado. Large groups of trees are being killed for the second year. About 20,000 acres of private and Bureau of Land Management lands are affected.

Douglas-fir mortality by the beetles has increased in western spruce budworm successively defoliated stands on the Roosevelt National Forest. Whether the beetles are responding to stress by defoliation or not is unknown at this time.

Scattered occurrances of Douglas-fir beetle were also detected on the Gunnison, Roosevelt, San Juan, and White River National Forests in Colorado and the Bighorn mountains in northern Wyoming.

DEFOLIATORS

WESTERN SPRUCE BUDWORM: Choristoneura occidentalis Freeman

Western spruce budworm remains widespread in the Region (Figure 2). Defoliation damage was mapped from the air, occurring on 2,750,311 acres in Colorado and Wyoming. The damage severity was classed as moderate based on ground measurements. In Wyoming, a decrease from 182,000 to 133,000 acres occurred whereas in Colorado there was an increase of 796,130 acres. Despite the slight decrease in the infestation in 1982 the five year trend shows an increase (Figure 3).

Egg mass surveys were conducted following the moth flight. Analysis of the survey data indicate there should be moderate to heavy defoliation in all the current infestation areas except the San Isabel National Forest where light defoliation is expected.

Along the Colorado Front Range 6,000 acres were treated by aerial application of pesticides to suppress budworm in 1983. This acreage treated is fifty percent less than the average annual acreage treated over the past 3 to 4 years. Pesticide materials used have been carbaryl, acephate, and Bt.

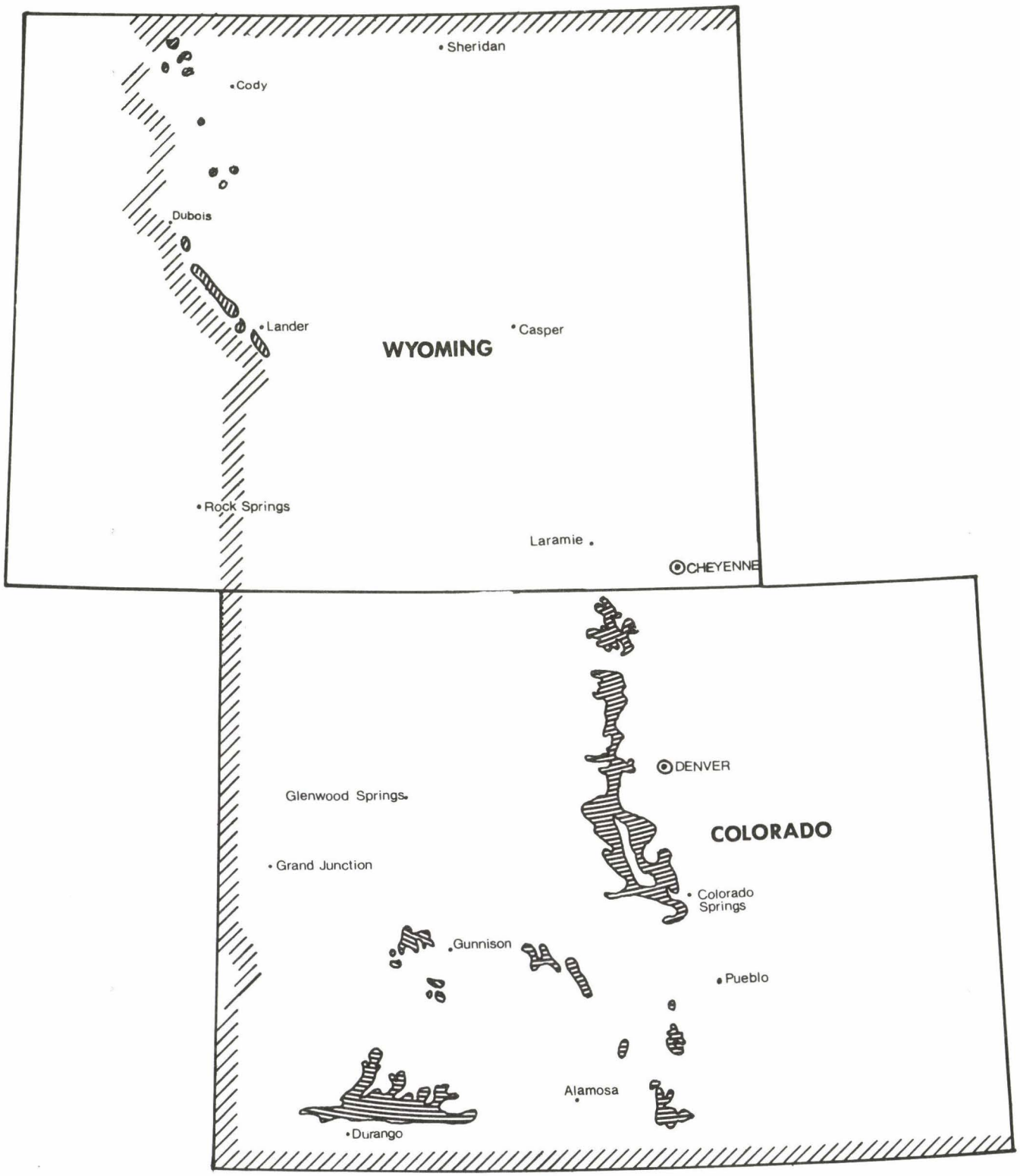
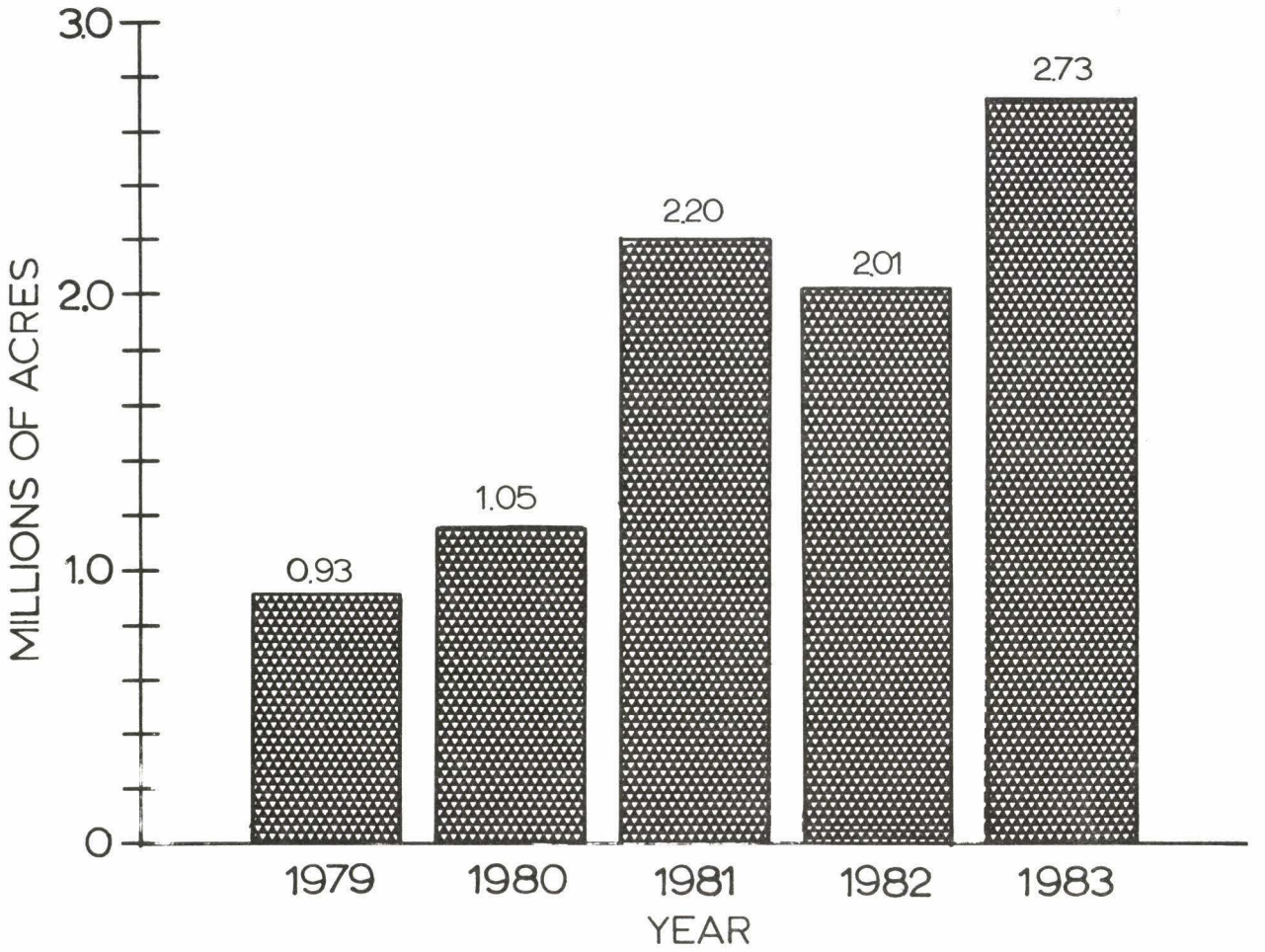


Figure 2--Western spruce budworm defoliation in the Rocky Mountain Region, 1983.

Figure 3 -- Western spruce budworm defoliation in Region 2, 1979-1983.



WESTERN TENT CATERPILLAR: Malacosoma californicum (Packard)

The western tent caterpillar infestation continued to expand in 1983 as predicted. The defoliated area now covers a gross area of 69,000 acres. The acres of defoliation almost doubled from 1982 when 36,000 acres were mapped. This infestation was first discovered on V-Rock Mountain of the San Juan National Forest in 1976. Spread of the infestation from V-Rock Mountain has been within the aspen host to the north and southeast. Expansion has been greatest to the southeast across private land along the Navajo River and now further east into the Rio Grande National Forest. An egg density survey conducted in August indicates the infestation will continue to expand in 1984. Disease, parasites and predators are present in the tent cat population, but thus far, have not collapsed the insect population as hoped.

DOUGLAS-FIR TUSSOCK MOTH: Orgyia pseudotsugata (McDunnogh)

Ornamental blue spruce continue to be defoliated in the Denver metropolitan area and other Front Range communities south to Colorado Springs and north to Fort Collins. Ornamental blue spruce defoliation has continued in most of the Front Range cities since it was first reported at Fort Carson, Colorado, in 1971 despite considerable spraying of individual trees to reduce damage.

Even though Douglas-fir (normally an acceptable host) occurs naturally, in the foothills in close proximity to many of these communities, an outbreak has not yet developed. However, two egg masses were discovered on an ornamental Douglas-fir near Evergreen, Colorado in October of 1983. This and other areas will be closely watched in 1984 for Douglas-fir tussock moth feeding or defoliation damage.

OTHER INSECTS

Insect	Host	Location	Remarks
Mountain pine beetle *Dendroctonus ponderosae* Hopk.	Lodgepole pine and ponderosa pine	Colorado, South Dakota, Wyoming	Mountain pine beetle in lodgepole pine continues to build. The outbreak in north central Colorado intensified in 1983 and tree loss estimates of the faders indicate there were about 800,000. In Wyoming, some infestation areas on the Shoshone National Forest are static in trend. However, elsewhere in Wyoming the trend is still increasing. Casper, Muddy, Shirley, and the Ferris Mountains all have expanding beetle outbreaks. The newest infestation area in the Little Snake River is expanding rapidly. In ponderosa pine, mountain pine beetle activity is down except on the Uncompahgre Plateau in Colorado. The mountain pine beetle along with with roundheaded and western pine beetles are jointly causing considerable tree loss in southwest Colorado.
Spruce beetle *Dendroctonus rufipennis* (Kirby)	Spruce	Colorado, Wyoming	Populations of spruce beetle continue with some increase on the Rio Grande National Forest. Timber sales are salvaging much of the loss in conjunction with trap tree logging and sanitation cutting. The Rabbit Ears infestation on the Routt National Forest is down following heavy salvage of the infested trees. Wyoming populations are low, and no new activity was noted in 1983.
Douglas-fir beetle *Dendroctonus pseudotsugae* Hopk.	Douglas-fir	Colorado, Wyoming	Scattered tree killing occurs in Wyoming and Colorado. Populations are building in Colorado, most notably at Douglas Pass north of Grand Junction.

Insect	Host	Location	Remarks
Western spruce budworm *Choristoneura occidentalis* Free.	Douglas-fir and white-fir	Colorado, Wyoming	Western spruce budworm is building momentum in 1983 after a small decline in 1982. Moderate defoliation was mapped on 2,750,311 acres. Egg mass survey results indicate there should be moderate to heavy defoliation in the same areas in 1984.
Douglas-fir tussock moth *Orgyia pseudotsugata* (McD)	Blue spruce	Colorado	Ornamental blue spruce in the metro communities along the Colorado Front Range continue to be defoliated, despite much ground spraying.
Western tent caterpillar *Malacosoma californicum* (Packard)	Aspen	Colorado	The western tent caterpillar outbreaks on the east side of the San Juan National Forest expanded greatly in 1983. The east side of the infestation now extends onto the Rio Grande National Forest. The gross acreage is estimated to be 66,000 acres on both National Forests and adjacent private lands.
Pine engraver beetles *Ips* spp.	Ponderosa pine, pinyon and lodgepole pine	South Dakota, Wyoming, Colorado, Kansas	*Ips* populations were prevalent in local areas in fresh slash and trees weakened from other sources.
Red turpentine beetle *Dendroctonus valens* LeConte	Ponderosa pine	Colorado, South Dakota	Populations at low levels.
Western balsam bark beetle *Dryocoetes confusus* Swaine	Subalpine fir	Colorado	Scattered loss continues throughout the range of fir in Colorado.
Pine Moths *Dioryctria ponderosae* Dyar *D. tumicolella* Mutuura, Munroe and Ross	Scots, Austrian, and ponderosa pines	Nebraska, Colorado, South Dakota	These two species have previously been reported as *D. zimmermani*. Damage is common in young pines in all three States in shelterbelts. Damage is most severe in central and western Nebraska.
Pine tip moth *Rhyacionia* spp.	Austrian, mugho, ponderosa, and Scots pines	Nebraska, Kansas, Colorado, South Dakota	Continues to be a problem on young pine, especially in shelterbelts and ornamentals.

Insect	Host	Location	Remarks
Fall webworm *Hyphantria cunea* (Drury)	Cottonwood, plum, chokecherry and wild rose	Kansas, Colorado, South Dakota, Wyoming	Fall webworm occurred commonly in cottonwood along drainages, especially in Colorado and South Dakota.
Western Tent Caterpillar *Malacosoma californicum* (Packard)	Serviceberry, bitterbrush	Colorado	Observed in Mesa Verde National Park and elsewhere in Colorado. Infestation in the San Juan National Forest continues to expand.
Forest Tent Caterpillar *Malacosoma disstria* Hubner	Green ash, and Crab apple	Colorado	Denver ornamentals suffered some defoliation.
Variable oak leaf caterpillar *Heterocampa manteo* (Doubleday)	Bur oaks	South Dakota	Scattered defoliation in South Dakota.
Bronze birch borer *Agrilus anxius* Gory	Birch	Colorado, South Dakota	A serious problem of ornamentals, particularly in the Denver metro area.
Oak twig girdler *Oncideres cingulata cingulata* (Say)	Red oak	Nebraska	Causing some branch mortality.
Green ash (lilac) borer *Podosesia syringiae syringiae* (Harris)	Green ash	Colorado, South Dakota	Causing major problems in many shelterbelts, especially in younger trees. Mortality, tree form damage and stem weakening have been reported. Some damage to young green ash in Denver and other Colorado urban areas.
Cankerworms *Alsophila pometaria* (Harris) and *Paleacrita vernata* (Peck)	Hackberry, honeylocust, ash and elm	Kansas, South Dakota	Defoliation occurred in many areas of the states.
Pine budworm *Choristoneura lambertiana* (Busck)	Ponderosa pine	Colorado	Defoliation damage was common in ponderosa pine along the Front Range and southern Colorado.

Insect	Host	Location	Remarks
Pitch nodule moth *Petrova* sp.	Ponderosa pine and pinyon	Nebraska, Colorado	Frequently found on young ponderosa in Nebraska. Very common on ornamental pinyon in Denver area.
Pine needleminer *Coleotechnites ponderosae* Hodges and Stevens	Ponderosa pine	Colorado, Wyoming	The needleminer infestations are primarily located on the Front Range. Populations appeared to be higher than in 1982. A 400 acre area of private land was aerially sprayed with acephate in October. The young larvae still entered the needles; apparently the aerial spray was unsuccessful. Ponderosa is infested near Cheyenne.
Leaf roller *Archips negundanus* (Dyar)	Boxelder	Colorado	Moderate feeding occured on boxelder along drainages and on ornamentals in Garfield and Jefferson counties.
Spruce spider mites *Oligonychus ununguis* (Jacobi)	Spruce	Colorado, South Dakota	A continuing problem state-wide on ornamentals and shelterbelts.
Pitch mass borers *Dioryctria ponderosae* Dyar *Dioryctria* sp. near *okanaganella* Mutuura, Munroe and Ross	Pinyon	Colorado	A serious problem of ornamentals, especially in Denver area.
White-marked tussock moth *Orgyia leucostigma* J. E. Smith	Hackberry, Silver, Maple and Elm	Nebraska	Caused extensive defoliation at scattered locations throughout the State.
Silver-spotted tigermoth *Halisidota argentata subalpina* French	Pinyon pine and juniper	Colorado	An outbreak of 10,000 acres with heavy defoliation was discovered south of Montrose; permanent damage is not expected.
Pine tiger moth *Halisidota ingens* Hy. Edwards	Ponderosa pine, pinyon pine	Colorado	Scattered, occuring in ponderosa and pinyon pine.

Insect	Host	Location	Remarks
Cooley spruce gall aphid *Adelges cooleyi* (Gillette)	Blue spruce, Engelmann spruce and Douglas-fir	Colorado	An ubiquitous pest of ornamentals.
Elm leaf beetle *Pyrrhalta luteola* (Muller)	American elm and Siberian elm	Colorado, Nebraska, South Dakota	A chronic pest of ornamentals in the metropolitan areas.
Oyster shell scale *Lepidosaphes ulmi* (L.)	Aspen and ash	Colorado	A chronic pest on ornamentals.
Pinyon Scale *Pityococcus ferrisi* McKenzie	Pinyon pine	Colorado	Observed at Mesa Verde National Park in 1983.
Pine needle scale *Chionaspis pinifoliae* (Fitch)	All pines	Colorado, Nebraska	A chronic pest of ornamentals in the metropolitan areas of Colorado. Very high populations exist on ponderosa pine on the Bessey division of the Nebraska National Forest.
Honey locust podgall midge *Dasineura gleditschiae* (O.S.)	Honey locust	Colorado, Wyoming	Caused some twig dieback and much aesthetic concern statewide in CO, and in Wheatland.
Strawberry root weevil *Otiorhynchus ovatus* L.	Strawberry and seedling trees	Colorado	The adults invade homes, annoying people.
Poplar blackmine beetle *Zengophora scutellaris* Saffr.	Cottonwoods	Colorado	Occurs statewide, causing blotch mines by late summer.
Honeysuckle leaffolding aphid *Hyadaphis tataricae*	Honeysuckle	Nebraska, South Dakota	Raising havoc in windbreaks and ornamentals.
Oak twig girdler *Oncideres cingulata* (Say)	Red oak	Nebraska	Causing some branch mortality.

Insect	Host	Location	Remarks
Ugly nest caterpillar *Archips cerasivoranus* (Fitch)	Plum and chokecherry	South Dakota	Near Sioux Falls, 25 acres were heavily infested, also several plantings along the Missouri River near Pierre.
Spruce needle miner *Taniva albolineana* (Kearfott)	Spruce	South Dakota	Occurs primarily in southeast quarter of the state.
Ash plant bug *Neoborus amoennus*	Green ash	South Dakota	Esthetic damage occurred on 80 trees in Rapid City.
Gypsy moth *Lymantria dispar* (L.)	Hardwoods	South Dakota	Egg masses were found in Custer during 1982 and male moths were caught in 1983.
Spittlebugs *Clastoptera* sp.	Utah juniper	Colorado	Spittlebugs were common at Mesa Verde National Park.
American dagger moth *Acronicta americana* (Harris)	Silver maple	Colorado	Minor feeding damage causing leaf drop in Denver metro area.
San Jose scale *Quadraspidiotus perniciosus* (Comstock)	Apple	Wyoming, Colorado	Heavy infestations in the Torrington area, and common in the Denver area.
Cottonmaple scale *Pulvinaria innumerabilis* (Rathvon)	Maples and boxelder	Wyoming	Infestations reported in maple at Torrington and boxelder in Big Horn county.
Putnam scale *Diaspidiotus* (*Aspidiotus*) *ancyclus* (Putnam)	Cottonwood	Wyoming	Occurs on older cottonwood in Laramie.
Leaf miner *Phyllonorycter* sp. probably *tremuloidiella* (Brown)	Cottonwood	Wyoming	Infestations are found in Converse, Goshen, Natrona, and Uinta counties.

Insect	Host	Location	Remarks
Cottonwood budgall mite *Aceria parapopuli*	Cottonwood	Wyoming	Continues to be a problem at Laramie.
Ash flower gall mite *Eriophes fraxiniflora*	Green ash	Wyoming	Population was heavy on some green ash in Powell.
Vagabond gall aphid *Mordwilkoja vagabunda* (Walsh)	Cottonwood and Aspen	Wyoming, Colorado	Problem continues at Laramie. Observed in many locations.
Western conifer seedbug *Leptoglossus occidentalis* Heidemann	Scots pine	Nebraska	Populations were very high in a seed orchard in eastern Nebraska.
Pine needle sheathminer *Zelleria haimbachi* (Busck)	Ponderosa pine	Colorado, Nebraska	Pine needle sheathminer is a common associate with pine budworm in Colorado. Infestations are light, except on Horning State Farm near Plattsmouth, NE, and at Pagosa Springs, CO, where the pest is abundant.

FOREST PEST MANAGEMENT WORKSHOPS:

The Forest Pest Management Group conducted a workshop in May on recognition and suppression of major forest diseases and insects in the Region. Training consisted of a two day workshop in the Regional Office. This session was attended by resource managers from the Colorado State Forest Service, the Bureau of Land Management, U.S. Air Force Academy (Natural Resources), National Park Service, and U.S. Forest Service. Several private consulting foresters also attended.

PESTICIDE USE IN REGION 2 - FY 83

Type of Pesticide	Chemical Used	Target Pest	Units Treated 1/	Application Method 2/	User 3/
Fumigant	Methyl bromide	Nematodes, root disease fungi, and weeds in nursery beds.	16	G	I
Fungicide	Benomyl	Phomopsis blight in eastern redcedar nursery beds.	77	G	I
	Zineb	Shothole disease in nursery beds.	3	G	I
Herbicide	Atrazine	Vegetation control (site preparation for tree planting).	10	G	I
	Bromacil and diuron	Weed and grass control around oil and gas facilities	1	G	III
	Dalapon	Vegetation control (site preparation for tree planting.	25	G	I
	DCPA	Annual and perennial broadleaf weeds and grasses in nursery beds.	13	G	I
	Dicamba	Canada thistle, leafy spurge, noxious weeds.	137	G	I
	Dicamba and 2,4-D	Canada thistle	16	G	I, II
	Glyphosate	Annual and broadleaf weeds in nursery beds.	10	G	I

1/ Units are in acres unless otherwise indicated.

2/ A = Aerial application.
G = Ground application.

3/ I = USFS.
II = Other Federal or public agencies.
III = Permitees, licensees, and grantees.

PESTICIDE USE IN REGION 2 - FY 83 Units

Type of Pesticide	Chemical Used	Target Pest	Treated 1/	Application Method 2/	User 3/
Herbicide (cont.)	Glyphosate	Canada thistle, leafy spurge, noxious weeds, yellow toadflax, weed and grass control.	88	G	I, III
	Ioxynil	Canada thistle.	3	G	I
	Oxyfluorfen	Annual and broadleaf weeds in nursery beds.	2	G	I
	Picloram	Canada thistle, larkspur, leafy spurge, toadflax, noxious weeds.	2,151	G	I, II, III
	Simazine	Annual weeds.	20	G	III
	Weedtrine II	Pond weed in fishing lakes.	2	G	I
	2, 4-D	Canada thistle, larkspur, leafy spurge, shrubby cinquefoil, Wyethia, noxious weeds.	503	G	I
	2, 4-D	Wyethia.	100	A	III
	2, 4-D	Sagebrush.	508	G	I
	2, 4-D	Sagebrush.	1,760	A	I, III
	2, 4-D	Sandsage.	6,427	A	III
	Tebuthiuron	Weeds.	1	G	I

PESTICIDE USE IN REGION 2 - FY 83 Units

Type of Pesticide	Chemical Used	Target Pest	Treated 1/	Application Method 2/	User 3/
Insecticide	Carbaryl	Cottonwood leaf beetle, grasshoppers in nursery beds.	3	G	I
	Carbaryl	Mountain pine beetle prevention.	700 trees	G	I
	Coumaphous	Cattle flies.	900 head	G	III
	Dimethoate	Pine tip moth in nursery beds.	68	G	I
	Ethylene dibromide	Mountain pine beetle control.	26,394 trees	G	I, III
	Lindane	Mountain pine beetle control.	10,279 trees	G	I
	Toxaphene	Lice, ticks, flies on cattle.	2,000 head	G	III
Piscicide	Rotenone	Control of suckers in fishing lakes.	15	G	II
	Rotenone	Brook trout.	113	G	II
Rodenticide	Aluminum phosphide	Ground squirrels.	500 burrows	G	I
	Aluminum phosphide	Prairie dogs.	390	G	I, III
	Strychnine	Pocket gophers.	32	G	I
	Zinc phosphide	Prairie dogs.	18,245	G	I, II, III

ACTIVE PROJECTS

Dwarf Mistletoes

1. Silvicultural control of dwarf mistletoe in young lodgepole pine stands. (FPM, RMFRES)

2. The role of animals in long-distance dispersal of lodgepole pine dwarf mistletoe. (RMFRES, North Central FES)

3. Effects of dwarf mistletoes on growth and yield in thinned lodgepole pine and ponderosa pine stands. (RMFRES)

4. Development and refinement of yield simulation models for dwarf mistletoe-infested stands in the central Rockies and Southwest. (RMFRES)

5. Investigation of the taxonomy, hosts, and distribution of the dwarf mistletoes in North America. (RMFRES, Univ. of Utah)

6. Development of a yield simulation model of mistletoe infected, irregular ponderosa pine stands. (CSU Dept. Botany and Plant Pathology, W. R. Jacobi and Graduate Students)

Comandra Blister Rust

7. Hazard-rating and ecology of comandra blister rust in the Rocky Mountain Region. (CSU Dept. Botany and Plant Pathology, W. R. Jacobi and Graduate Students)

8. Management of lodgepole infected by comandra blister rust in the Rocky Mountain Region. (CSU Dept. Botany and Plant Pathology, W. R. Jacobi and Graduate Students)

Root Diseases

9. Association of Armillaria root disease and mountain pine beetle in ponderosa pine in the Black Hills, S.D. (FPM, RMFRES)

Decays

10. Phellinus robineae stem decay of black locust; infection and damage. (RMFRES, Lincoln)

11. Windthrow and decay in beetle-killed Engelmann spruce in Colorado. (RMFRES)

12. Fomes fraxinophilus stem rot of green ash: incidence and damage. (RMFRES, Lincoln)

Stem Diseases

13. Evaluation of cankers and decays in partially cut aspen stands in Colorado and New Mexico. (FPM, R-2, R-3, RMFRES)

14. Longevity of aspen trees affected by Cenangium canker. (RMFRES)

15. Role of phytotoxins in damage to aspen caused by Cryptosphaeria. (RMFRES, BYU)

16. Thyronectria canker research. (CSU Dept. Botany and Plant Pathology, W. R. Jacobi and Graduate Students)

17. Canker diseases of honeylocust; etiology, infection, and disease development. (RMFRES, LINCOLN)

18. Canker diseases of cottonwood: etiology, infection, and disease development. (RMFRES, Lincoln)

Foliage Diseases

19. Evaluation of air pollution effects on ponderosa pine in the Colorado Front Range. (FPM: RMFRES)

20. Inheritance of resistance to Dothistroma pini in Austrian pine. (RMFRES, Lincoln)

21. Resistance to Phomopsis juniperovora in geographic sources of Juniperus virginiana. (RMFRES, Lincoln)

22. Resistance to Cercospora sequoiae var. juniperi in geographic sources of Juniperus virginiana and J. scopulorum. (RMFRES, Lincoln)

23. Diplodia pinea tip blight of pines: etiology of stem infections. (RMFRES, Lincoln)

24. Growth of germ tubes positively-directed toward stomates -- Is this a common phenomenon of fungi infecting plant foliage? (RMFRES, Lincoln)

Recreation Site Pathology

25. Tree diseases and their effects in recreation areas. (RMFRES, FPM)

Nursery Diseases

26. Evaluation of soil solar heating for control of soil-borne pathogens and weeds in Rocky Mountain Region Forest Tree Nurseries. (FPM)

27. Chemical control of shothole on chokecherry at the Bessey Nursery. (FPM)

Mycorrhizae

28. Endemic ectomycorrhizal fungi of ponderosa pine in central Great Plains plantings: identification of fungi, synthesis of mycorrhizae, and growth of symbionts in pure culture. (Kansas State University)

29. Responses of Pinus to mycorrhizae formation: the interaction of nutrients, photosynthesis, carbohydrate allocation, and growth pattern. (C.P.P. Reid, Dept. Forest and Wood Sciences, CSU)

Miscellaneous

30. Interactions among iron availability, microbial siderophores, and decomposition. (C.P.P. Reid, Dept. Forest and Wood Sciences, CSU)

31. Microbial processes in mineralization of nutrients: a comparison between ecosystems. (C.P.P. Reid, Dept. Forest and Wood Sciences, CSU)

Tree Disease Handbook for the Great Plains

A handbook "Diseases of Trees in the Great Plains" is being prepared. The preparation of the handbook is being coordinated by Jerry W. Riffle (coordinator) and Glenn W. Peterson (co-coordinator). The handbook will contain 65 articles prepared by over 30 contributors and will include color photographs. The current schedule calls for completion of the handbook in 1984 with publication in 1985. Thirty-seven manuscripts have been completed and are being edited. Preparation of this handbook is a venture of the Pest Management Task Force of the Forestry Committee of the Great Plains Agricultural Council. The Forestry Committee has responsibility for securing funds for publication.

INSECTS

Defoliators

1. Impact of carbaryl and Bt on nontarget insects. (RMFRES, Lincoln; NDSU, Fargo)

2. Evaluation of the impact on tolerance to and resistance to cankerworm defoliation of Siberian elm in North Dakota shelterbelts. (RMFRES, Lincoln; ARS, Mandan)

Borers

3. Biology and control of Zimmerman pine moth. Identification of host and site characteristics influencing the infestation of pines by the Zimmerman pine moth. (University of Nebraska)

4. Monitoring and predicting western pine tip moth (Rhyacionia bushnelli Busck), adult flight periods, egg hatch, and development rates in eastern Nebraska. (RMFRES, Lincoln)

3. Screening synthetic attractants for male Olethreutid moths attacking ponderosa pine. (RMFRES, Lincoln)

4. Biology of Petrova luculentana. (RMFRES, Lincoln)

5. Test of insecticides for control of Petrova metallica Miller in ponderosa pine. (RMFRES, Lincoln)

Seed and Cones

6. Identification, life history, and control of ash seed weevils infesting green ash and lilac in North Dakota. (RMFRES, Lincoln)

7. Incidence of parasitism on western spruce budworm after application of chemical insecticides. (RMFRES)

8. Distribution of western spruce budworm egg masses on white fir and Douglas-fir. (RMFRES)

9. Distribution of western spruce budworm parasites within tree crowns. (RMFRES)

10. Use of acephate implants for control of the ponderosa pine needle miner. (RMFRES; Colorado State Forest Service)

11. Biology of a pinyon tip moth, Dioryctria sp. on pinyon. (Colorado State University)

12. Biology and taxonomic characteristics of two species of pitch mass borers, Dioryctria ponderosae and Dioryctria sp. okanaganella. (Colorado State University)

13. Chemical control of Dioryctria sp. and Zelleria sp. moths on pinyon. (Colorado State University)

14. Western spruce budworm host-plant relationships. (Colorado State University)

15. Life history, impact and control of seed and cone insect species found on Pinus ponderosa Laws. in eastern Nebraska. (RMFRES, Lincoln)

Miscellaneous

16. Evaluation of spruce cone damage due to insects in Colorado. (RMFRES)

17. Effect of herbicide application on insects that occur in sagebrush sites. (RMFRES)

18. Monitoring walnut curculio damage in a walnut seed orchard in Kansas. (Kansas State and Extension Forestry)

19. Investigation of insects associated with eastern redcedar mortality in Kansas shelterbelts. (Kansas State and Extension Forestry)

RECENT PUBLICATIONS

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